SOL-GEL SYNTHESIS OF SiO_2-TiO_2-F POROUS AND MONOLITHIC MATERIALS

E.N.Poddenezhny, A.A.Boiko, A.A.Alexeenko, O.A.Stotskaya
Gomel State Technical University, 48, October av., 246746, Gomel, Belarus
podd@gstu.gomel.by

The sol-gel method has received considerable attention for synthesis of SiO_2-TiO_2 glass, which has a high refractoriness and low thermal expansion coefficient. In particular SiO_2-TiO_2 glass containing 7-8 wt. % TiO_2 has a zero thermal expansion coefficient in a wide range of temperatures. Incorporation of fluorine, oxides of rare-earth and transition metals into silica matrixes allows to create new anhydrous glass like materials with improved spectrum - luminescence characteristics. These materials are perspective for fiber optics, electronics, and laser technique.

The aim of the present work is the investigation of novel method of synthesis porous and monolithic materials of SiO_2-TiO_2-F system, using the fumed silica (aerosil) and $(NH_4)_2TiF_6$ as fluorine and titanium-containing compound.

The fluorine containing silica gels were prepared by sol-gel process including the following stages: hydrolysis of tetraethyl orthosilicate (TEOS) in a three-component system $Si(OC_2H_5)_4$-H_2O-HNO_3 of staring compounds with ratio of 1:16:0.01, addition of fumed silica (aerosil) into the sol, thorough dispersion in an ultrasonic bath, centrifugation for separation of impurities and agglomerates, neutralization by the ammonia solution of the reaction mixture up to pH=5.5-6.5, sol casting into plastic containers, gelation, washing the gels in distilled water, drying and incorporation fluorine and titanium into xerogels by the procedure of impregnation in acetone-water $(NH_4)_2TiF_6$ solutions, drying at a temperature 60°C, sintering in a muffle furnace and holding at a temperature 1100-1300 °C during 1.5-2.0 h.

The structural and optical properties of synthesized samples have been investigated. SEM and AFM analysis were used for characterization of xerogels and glass structure and morphology. The optical properties of pure and fluorine, titanium-containing silica glasses were studied by VIS- and IR-spectroscopy.